Arteries of Life:

The Complete Process for Building and Upgrading Roads in Western Australia and; Roads in the Southern River Electorate

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Executive Summary

The purpose of this report was to examine the process for building and upgrading roads in Metropolitan Western Australia, and to review previous road projects in the Southern River Electorate on certain roads. Research for this report included a review of current literature from a number of sources, as well as two interviews of key persons in the road building industry and a number of email inquiries to road building authorities.

In Part A, all of these findings have been organised into a road building process. The initial idea for a road project can come from a great many sources, but these are often confined to government and intergovernmental bodies. A road is legally planned by an amendment of the Metropolitan Regional Planning scheme, and Local Planning Schemes. The process for amending the schemes differ with the size of a road project. But a project needs to be funded if it is to become reality. There are processes in place to ensure that money is redistributed from those people who use the system, to those that maintain it. There are a number of strategies to deliver a project, but most use the private sector in some way. To fairly include and harness these contractors, a tendering process has been set up by Main Roads and Local Government. The design of a project is massively important to eventually assess its success. Context-sensitive design emphasises a design that matches the context of the road project. All this is eventually implemented when a project is constructed. After it is built, work on the project does not end. It has to be maintained to a high standard to prevent it degrading to an unusable state.

It is clear that while the road building process is complex, but this should not be interpreted as a weakness: despite decades of underfunding, Western Australians continue to enjoy a relatively well-maintained and efficient system. I have however recommended that more research take place on the process of road building in Western Australia. I also made two other minor recommendations:

- MRWA needs to outline the process(es) which it goes through when tendering work.
- More cooperative research on road maintenance needs to done with other Australian states and other nations.

In Part B, the major finding was that a great deal of work has been completed on Nicholson Road, Warton Road, Southern River Road, Garden Street and Ranford Road. This was due to the growth in population in the area. Projects were not confined to only minor work; indeed, some major projects are still currently ongoing. Furthermore, the relevant road authorities plan to continue upgrading these routes as the area develops.

However, given that there is an extreme lack of information on completed projects, I recommended that a report should be generated when a project is completed with details of what the road authority has done. This report could either remain archived with the road authority, or be made available to the public.

PART A: THE PROCESS OF BUILDING AND UPGRADING ROADS

PART B: ROADS IN THE SOUTHERN RIVER ELECTORATE

Part A: The Process of Building and Upgrading Roads

Introduction

Roads are essential to the Western Australian way of life and economy. In Metropolitan Western Australia alone, there are over 12,000 kilometres of sealed roads (Planning and Technical Services Directorate of Main Roads WA 2008). Each year, that number grows. Road building in Western Australia is not one, formal process. Rather, it is a number of processes carried out by various organisations and authorities concurrently. These organisations rely on largely informal communication networks between themselves to ensure project outcomes are successful. In this report, I aim to create one process of construction and upgrading of roads in Metropolitan Western Australia, by tabulating the various processes into one formal document. I will begin with the initial idea for a road project, and then I will describe how it is planned, financed, delivered and constructed. Finally, in the post-build section of this report, I will discuss upgrading and the maintenance of a completed project.

I see the report as a general outline, and so highly technical descriptions have been omitted purposefully, with the intention to keep the processes easy to understand.

Further, the scope of this report is limited to the road asset in Metropolitan Western Australia, an area defined by the administrative borders of MRWA metropolitan division. A map of this area can be found in MRWA's Regional Digest (ibid, 28). As such, I largely ignore regional Western Australia, although I sometimes allude to practices there for the interested reader.

Throughout the report, I refer to two classes of roads: local and state. Local roads are owned and managed by the relevant Local Government, and state are owned and managed by Main Roads Western Australia. The divide is quite necessary, as the administration of the different types is not the same.

Initial Idea

The idea for a project can come from many origins. Projects can span authorities, localities, purposes and scales. As such, the permeability of the process to ideas is definitely a strength of the Western Australian road building process.

Idea

The initial idea to build or upgrade a road can come from many sources and management structures:

- Federal Government, Specifically, the Department of Transport and Infrastructure.
    - The Federal government provides funding to the state for roads. They also provide funding for specific programs and projects. A list can be found in the Bureau of Infrastructure, Transport and Regional Economics' Public road-Related Expenditure and Revenue in Australia information sheet (Malam and Lubulwa 2011, 8).
        - Ideas can come from the department in the form of funding for specific projects.
- Western Australian Minister for Transport
    - The Minister for Transport manages the Western Australian Transport portfolio, which includes: the Public Transport Authority, Main Roads Western Australia, and the Department of Transport (Government of Western australia N.D).

        - Roads in Western Australia have long been part of an integrated transport network. This means that the transport objective of roads only make sense when considered in the context of the public transport, rail, the cycle network, and footpaths. Through managing this portfolio, the Minister manages the strategic direction of transport in the state, and as such, is a source of ideas about the construction or upgrade of specific roads.
- Department of Transport
    - The Department provides "safe, accessible, sustainable and efficient transport services that promote economic prosperity and enhance the lifestyle of all Western Australians". It deals with roads as part of the integrated transport network.
        - Whilst the Department does not provide the strategic leadership that the Minister does, it does advise the Minister on possible policy directions.
- Western Australian Minister for Planning
    - The Minister for Planning manages the town planning section portfolio of the Western Australian government. It includes the Department of Planning, LandCorp, the Metropolitan Redevelopment Authority and the Western Australian Planning Commission.
        - The Minister for Planning has a direct impact within the process for major amendments to the Metropolitan Regional Planning Scheme. For details, see below.
- Western Australian Planning Commission (WAPC)
    - "WAPC responds to the strategic direction of government and is responsible for the strategic planning of the State." (WAPC 2011).
        - The WAPC is one of the most prolific organisations which has ideas about roads. Beginning with the Stephenson and Hepburn plan for Perth in 1955, Perth has had a number of strategic plans for the metropolitan area (Prattley 2010, v). They all outline major transport corridors and roads. The current strategy is outlined in Directions 2031. In many ways, it has been advantageous to have such long-term plans. For example, the land for the Roe Highway was purchased for only 10 pounds an acre (Edmonds 1997, 137). The WAPC administrates and maintains this strategic plan.
- Commissioner of MRWA/Director General of the Department of Transport/Chief Executive Officer of Public Transport Authority
    - These positions are held by one person with the view to "integrate and enhance the co-ordination of the State's transport operations, regulatory functions and policy development processes" (Department of Transport 2011).
        - Any potential road projects have to work within the state transport strategy. Reece Waldock, who currently holds the three positions, has been tasked with making separate transport policies cohesive, and therefore will change projects to suit this goal.

- Main Roads Western Australia (MRWA)
    - MRWA is the department which is responsible for state roads in Western Australia.
        - MRWA has gone through a great deal of changes in the past 20 years. Prior to the early 1990s, MRWA planned and constructed the state roads; however, today MRWA is a service provider. They contract most new, upgrade and maintenance work to the private sector (Edmonds 1997). However, MRWA still has a great deal of technical knowledge and expertise in regards to roads and road building, and still administrates the building of state roads.
- Local Government (LG)
    - LG's are responsible for all roads in their districts which are not the responsibility of MRWA, or the responsibility of a specific authority (such as national parks or special development zones).
        - LGs are responsible for a great number of the initial ideas for road projects. In 2009, 72% of roads in WA were managed by LGs (Mitchell n.d.). Not only do they maintain Local Planning Schemes (see below), but their road departments are also responsible for the implementation of some specific projects on their roads (Tennakoon 2012). These include Black Spot and Roads to Recovery. Often, the LG would have the initial idea for one of these projects, and then apply for funding from another source.
- Regional Road Groups (RRG)
    - There are nine regional road groups in Western Australia. They are a collection of LGs and a MRWA representative who plan how to spend the grants from the State Road Funds to Local Government agreement.
        - The most pertinent to the current study is the Metropolitan Regional Road group, and its sub-groups. The purposes of the Central Technical Sub-Group, according to one of its members the City of Vincent, is to "make recommendations to the Metropolitan Regional Road Group in relation to the Annual Local Governments' Road Program, State Black Spot Program, Roads 2025 Strategy" (City of Vincent n.d).
- Metropolitan Redevelopment Authority
    - The Metropolitan Redevelopment Authority falls under the planning portfolio, and as such is managed by the Minister for Planning. It has been tasked with redeveloping certain urban spaces in the metropolitan area (MRA 2012). They often include representatives from the local area, vested in Land Redevelopment Committees (MRA 2012).
        - Redevelopment Authorities also deal with infrastructure for their zones. For example, in the Elizabeth Quay Project, the Georgiou Group has been contracted by Metropolitan Redevelopment Authority to begin roadwork in the area (MRA 2012).
- Roadwise Advisory Groups

- Funded by the Road Safety Council of Western Australia, Roadwise Advisory Groups compose of representatives from WA Police, the council, and local community groups. They meet at each local government and advise on road safety issues.
    - As they have been empowered to "achieve a safer road environment", An idea to improve a local stretch of road can originate with this group (City of Gosnells 2012).

Planning

Levels of Planning

Roads

The Process of Minor Amendments

The Process of Major Amendments

Philosophies to Consider when Planning a Project

It could be argued that Town Planning has become a tradition in Metropolitan Western Australia. This tradition serves road building projects well, meaning that Western Australians have been blessed with a relatively cheap and efficient system.

Levels of Planning

In Western Australia, there is a town planning hierarchy.

The State Planning Strategy, prepared by the WAPC, outlines a "vision for the future of Western Australia" (WAPC 2007, 5). It is a plan at the state level: it outlines a way for government to improve infrastructure, community, economy, and environment (ibid).

The next level of planning is Region Planning Schemes. These schemes coordinate planning for a particular region between different authorities. As such, they can include several LGs. The main purpose of RPSs is to define land uses in a given area. This is achieved through declaring certain areas zones for specific uses (such as residential, industrial, etc.).

The most pertinent at this level of planning for the purposes of this report is the Metropolitan Region Scheme, which administrates an area from Yanchep to Golden Bay.

Finally, under the Planning and Development Act 2005, LG's are required to prepare Local Planning Schemes. These detail how land is to be used in the LG's area, and they also

"include provisions coordinate infrastructure and development in a locality" (ibid, 8). They are a great deal more detailed than RPSs, but are subservient to them.

This planning hierarchy is glued together by planning policies, which are developed by the WAPC. The purpose of these policies is to ensure that consistent decisions on development applications are obtained.

Roads

It is essential to understand these levels of planning when discussing the planning system of roads. To legally construct or upgrade a road, an amendment has to be made to the Region Planning Scheme.

Amendments fall into two categories: Minor and Major. The WAPC decides which an amendment should be. The Amendment process is governed by the Planning and Development Act 2005.

The Process of Minor Amendments

- The WAPC prepares the amendment
- The amendment is sent to the Environmental Protection Authority (EPA) for it to set the appropriate level of environmental assessment and complete an environmental review if needed. A copy is also sent to the Minister for Planning.
- The amendment (and, an environmental review, if it has been completed) is made available to the public for comment. This is done through newspapers and the PlanningWA website. Any affected landowners are also informed by writing.
- After 60 days, The WAPC considers the submissions it has received, incorporates any environmental considerations from the EPA, and submits a recommendation in the form of a report to the Minister for Planning.
- If the Minister approves without any changes, the amendment takes effect in the MRS once it has been gazetted.

The Process of Major Amendments

- The WAPC prepares the amendment
- The amendment is sent to the Environmental Protection Authority (EPA) for it to set the appropriate level of environmental assessment and complete an environmental review if needed.
- A copy is also sent to the Minister for Planning, and consent asked to advertise.
- If the Minister consents, the amendment (and, an environmental review if it has been completed) is made available to the public for comment. This is done through state-wide and local newspapers and the PlanningWA website. Any affected landowners are also informed by writing.
- After three months, the WAPC considers the submissions it has received, incorporates any environmental considerations from the EPA, and submits a recommendation in the form of a report to the Minister for Planning.
- The modified amendment may be resubmitted to the public if the Minister judges it necessary (the amendment may be substantially changed).

- The minister submits the amendment to the Governor of Western Australia.
- Given the approval of the Governor, the amendment is placed before each House of Parliament. It is also available to the public with the WAPC's report.
- The amendment may be disallowed by a Member of Parliament; if not, it then takes effect in the MRS.
- Within three months of this happening, affected LGs are required to begin amending their Local Planning Schemes.

Philosophies to Consider when Planning a Project

There are a number of principles and philosophies that have to be taken into consideration when any road project is planned.

Water management principles began to change in the early nineties, as it was realised that the then current design philosophy was leading to not only water being wasted, but damage to wetlands and river ecosystems (X 2012). Water Sensitive Design was the interagency response to this problem. It aims to be "economic, aesthetic and sustainable" (Moran, et al. n.d., 5). It (ibid, 6):

- Manages the water balance
- Ensures a standard of water quality, and where possible, tries to improve the quality available
- Emphasises water conservation
- Maintains both "water related environmental values" and "water related recreational values" (ibid).

To achieve all this, Moran et al developed six Best Planning Practices which are supported by six Best Management Practices. All these directly impact on how an area can be developed and in doing so, the planning of roads in a new development.

Another philosophy which must be taken into account is that of conserving road verges. It has been proven that this encourages biodiversity and provides "corridors for wildlife to move between substantial remnants of vegetation" (Edmonds 1997, 355). It also encourages rare species (MRWA and Government of Western Australia 2002, 8.8). Almost 24% of all declared rare flora populations occur in LG and MRWA road verges (Roadside Conservation Commitee 2000, 5). It is important to manage road verges correctly to conserve these environmental assets. The Roadside Conservation Committee has created a general process for the protection of Special Environmental areas (ibid, 38).

Fauna and flora are not the only thing at risk from activity in road verges. Heritage sites can also be located in road verges. These can include Aboriginal and settler places of importance. However, care needs to be taken in identifying these sites, as they have suffered vandalism in the past (ibid, 36). Given this situation, Aboriginal communities have requested that they be consulted about the way these sites are managed (ibid).

Further, memorials to persons who have been killed in accidents are often located in verges. Memorials are administrated by MRWA (2010).

But road verges are multi infrastructure use areas. They can include (Utility Providers Services Committee 2010):

- Gas
- Electricity
- Telecommunications
- Water
- Sewerage
- Main Drainage
- Street Drainage
- Traffic signals, Roadway Lighting and Intelligent Transport Systems cables

When planning a road, it is important that these services are considered. There has to be enough space to place them in the verge, and to be accessible to the relevant authority (this is why services cannot be placed under the road).

Financing a Project

It is essential that money finds its way from those who use the system, to those who have the responsibility for it. Without this process, projects cannot commence.

Costings

For state roads, the costing process falls to MRWA. For local roads, costings are completed internally by the LG(s) (Tennakoon 2012).

Who Pays?

While the Western Australian road system is owned by the State Government and Local Governments, it is also funded from the federal sources and private sector transfers and contributions.

Source of funds: State Roads

State roads are the responsibility of MRWA, and are funded from the following sources:

- Federal (MRWA 2011, 143)
    - Nation Building Program
        - With the introduction of the *Nation Building Program (National Land Transport) Act 2009,* grants are received from the Federal

government to improve the nation's infrastructure. Programs included are:
        - Heavy Vehicle Safety and productivity
        - Boom Gates for Railway crossings
        - Black Spot Program
        - Local road and National Road Projects
    - Jobs Fund – Infrastructure Employment Projects
        - The Commonwealth provides grants to create jobs and train people through infrastructure projects. The grants are provided through the Jobs Fund.
    - Interstate Road Transport Act 1985
        - Under the act, interstate vehicles that are exempt from state charges are required to pay a levy. The money is redistributed to states in "accordance with the damage attributed to interstate vehicles in each state" (ibid).
- State (Malam and Lubulwa 2011, 9)
    - Petroleum products excise
    - Vehicle registration
    - 73% of Driver licence fees
    - Stamp duty on vehicle registration
    - GST (car purchases and their maintenance and use)
    - Fringe Benefits Tax
- LG
    - In specific cases, roads may be transferred between LG and MRWA. This process is outlined in *Guidelines for determining and assigning responsibility for roads in Western Australia Part 1: Policy for classification, proclamation and transfer of Western Australian roads* (MRWA 2011)
- Private
    - Under the Western Australian Planning Commissions Policy No. DC 1.7 (1998):
        - if the WAPC and concerned road authority agree that a road needs to be upgraded or constructed for a new development, as a condition of subdividing a lot, the concerned road authority may either:
            - Bill the subdivider the amount of money they have costed upgrading a road to be, or;
            - Order the subdivider to carry out the works (ibid, 3.2.3).
        - Land may be required to be ceded free of cost as a condition of sub-dividing, to the road authority, where:
            - A new truncation is needed or upgraded
            - A road needs to be widened
            - A Primary or District Distributor is needed. The subdivider also is required as a condition to contribute to the cost of building these roads (ibid, 3.3, 3.1, 3.7).

Source of funds: Local roads

Local roads are the responsibility of Local Governments, and are funded from the following sources:

- Federal
    - Identified local road grants
    - Nation building Program
        - Roads to Recovery
        - Black Spot Program
        - Off network programs
        - National Network Maintenance
- State
    - Through the State Road Funds to Local Government agreement (SRFLGA) 27% of vehicle licence fees are spent on Local Roads. There are three main categories for the funding (information in SRFLGA Procedures (MRWA 2009, 5)):
        - Category 1 (60% of the 27%, implemented by LGs)
            - Strategic and technical support
                - The State Road Funds to Local Government Committee SRFLGC determines the allocation necessary for this support.
                - A list can be found of the support in State Road Funds to Local Government Agreement (Government of Western Australia, MRWA and WALGA 2011, 5.2.4)
            - (Commodity Route – For Regional Road Groups only)
            - Direct Grants
                - Allocated to LG annually by the Western Australian Local Government Grants Commission (WALGC) using the Assets Preservation Model.
            - Road Project Grants
                - Money for specific projects on Local Roads. The eligibility for funding in the Metro area are:
                    - Average Annual Daily Traffic exceeds 2000 cars a day, or;
                    - The design exceeds 10000000 equivalent standard axles over a 20 year's design life, and;
                    - Is classified as Access road, District or Local Distributor (MRWA 2009, 14-5).
                - Road Project Grants are the sum of money which is left, after the allocation for the other sectors have been subtracted from the 60%. It is then distributed to the Metropolitan Regional Road Group and the Rural Regional Road Group on a basis of 36% and 64% respectively.
        - Category 2 (25% of the 27%, implemented by MRWA)

            - Traffic management and Road Safety (Government of Western Australia, MRWA and WALGA 2011, 5.2.5)
                - Road markings
                - Signs
                - Traffic signals
                - Railway crossings
                - Safety and traffic improvement projects
                - State Black Spot Program
            - Bridge works/inspections
                - (Some of this funding is also from Federal sources, as outlined above.)
            - Remote Access Roads to Aboriginal communities
            - National Parks (DEC), Rottnest Island and King's Park
        - Category 3 (15% of the 27%, implemented by the state)
            - State Initiatives on Local Roads
                - MRWA provides a program of works to the SRFLGAC for their approval.
- Local Government (Shepherd 2011, 31)
    - Council Rates
    - Loan funds
    - Funds from Accumulated reserves
    - General Purpose grants from the WA Local Government Grants Commission
- Private
    - [see above]
    - State Planning Policy 3.6 Development Contributions for Infrastructure
        - LGs can claim for the cost of infrastructure from developers, when new developments are shown to need it. The methodology and conditions are outlined in both Planning Bulletin 100 and State Planning policy 3.6 (WAPC 2009) (Western Australian Government Gazette 2009)

Furthermore, the road authority can seek funding for cycle/footpaths and bus stops from other sources (bus stops are funded on a 50:50 basis with PTA; cycleways 50:50 with the Department of Transport (X 2012)).

Source	2005-6	2006-7	2007-8	2008-9	2009-10
LG	211.5	223.5	259.8	294.1	315.8
State	72	86.1	84.4	94.9	112.2
Federal	122.6	135.3	143.3	155	160.5
Private	6.1	5.8	11	21.2	11.1
Total	412.2	450.7	498.5	565.3	599.6

Figure 1: Source of funds for local roads in millions of AUD (WALGA 2011)

Delivery Strategies

Delivery strategies have changed vastly through the years. In the past, both MRWA and LGs used their own workforces to complete the work themselves. Especially at MRWA, this changed in the early 1980's (Edmonds 1997). Today, most of the physical work is not completed by MRWA or by LGs, rather, it is completed by contractors.

Strategy models

There are a number of different delivery strategies which can be used on a given project (Brown, et al. 2009, 7):

- In-house
  - Everything is done by the road authority
- Design/construct
  - Both the design of a road and the construction of it are done under different contracts
- Hybrid, detail and construct
  - The contractor does some design work, and the construction.
- Design, novate and construct
  - The authority engages consultants to partly design the project to the extent that the needs of the authority and objectives are well defined. Contractors are invited to help with the design details, but before the design is complete,

the project is tendered. The winning contractor then completes the design, working with the original consultants, and finally builds the project (Carmichael 2000, 122).

- Design and construct
    - In this model, the contractor both designs and constructs the road.
- Design, construct and maintain.
    - The contractor also maintains the road for a set amount of time.
- Commercial development
    - An example might be BOOT (build, own operate and transfer). This means that a project is commissioned by government. The contractor designs, builds, and maintains the project. However, the contractor holds the lease only for a set amount of time. They are entitled to all revenues raised from the project in this timeframe, before the project is transferred to government. However, the contractor has to raise the initial funding for the project (Worldbank 2011).
- Public-private-partnerships
    - "Broadly, PPP refers to arrangements, typically medium to long term, between the public and private sectors whereby part of the services or works that fall under the responsibilities of the public sector are provided by the private sector, with clear agreement on shared objectives for delivery of public infrastructure and/ or public services." (Worldbank 2011). Australia's policy framework has been published by Infrastructure Australia (2008).
- Alliance
    - The project management, design, construction and maintenance of a project all fall under separate contracts.

Both MRWA and LGs use a combination of these methods. However, MRWA has a preference for the Alliance model, and LG with the Design/Construct model.

In a particular project, if other authorities are involved in the designing process as well (such as subdividers) the road authority must ensure that they communicate to avoid idiosyncrasies in the output.

A Scale of Strategies

These strategies can be thought of as if on a scale.

At the top of the list at in-house, the private sector (contractors, capital etc.) has nothing to do with the project. At the bottom of the list, the PPP and Alliance models are very much integrated with the public sector.

Brown et al argue that there is a sliding scale of risk to the road building authority as well. There is a great deal of risk at the top of the list for the road authority. However, at the bottom of the list, risk is almost non-existent (2009, 8).

But, *Maintaining the State Road Network,* a report by the Western Australian Auditor General on the state of the state road system, shows that care must be taken when contracting to the private sector (2009).

Project Delivery

A workforce is necessary to actually complete the work. Who does, and how they are chosen, is subject to a further process in the road authority.

Tendering

Tendering plays a huge part in the process for project delivery. It is the main way in which contractors are recruited to take part in a project. Work is tendered out from MRWA and LG to contractors with the following objectives:

- To achieve value for money
- To outsource some responsibility and risk to the private sector
- To encourage innovative responses to problems

The process for tendering is slightly different for MRWA and for LGs.

Local Government Tendering Process

Under the *Local Government Act 1995,* "A local government is required to invite tenders before it enters into a contract of a prescribed kind under which another person is to supply goods or services." The process can vary between LGs, and for the size of projects, but is largely similar. Here, I have shown the process for the Shire of Kalamunda (Shire of Kalamunda n.d.) for a large project.

- Appointment of an evaluation panel

    - A group of persons with knowledge in the particular field of the work to be completed.
- Project definition and scoping
    - Budget prepared internally by the LG
    - Project manager appointed
    - A time estimate prepared
    - A selection criteria for the contractors prepared
    - A document prepared which clearly defines the scope of the project and the requirements upon the successful contractor. Further, any constraints on the project are included.
- Tender documents prepared
- Call for tenders
    - Tenders have to be advertised statewide (the advertisement has to be approved by the Chief Executive officer)
    - Public notice is a minimum of 14 days
    - Tenders are required to include:
        - A description of the what the LG requires
        - Details of a contact person
        - Where and how the tenders can be submitted
        - The deadline
    - The LG answers questions and queries, and amends the tender documents if necessary.
- Close of tenders
- Tender submissions are opened
    - Tenders need to be held securely by the CEO until this takes place. Members of the public can attend, but pricing information is not released.
- Evaluation of submissions
    - Submissions are evaluated by the panel with close regards to the selection criteria of the work. Incomplete or non-conforming submissions are rejected, and the reasons for doing so communicated to the tenderer.
    - All evaluation documents are retained as proof that a fair and transparent process has taken place.
    - LG may also contact the tenderer for further information if needed.
- Award of tender
    - A Tender Evaluation Report is generated. It should clearly outline the method which the panel used to select a tenderer, and why the final decision was made. The report is an internal document for the LG.
    - Those tenderers who are unsuccessful are contacted and told of the LG's decision. Debriefings as to why may be held. Documents from unsuccessful tenderers are retained.
- Approval of tender
    - Tenders over 250,000 dollars in value are required to be approved by the Council. However, up to this value the CEO may approve applications.

Main Roads Western Australia tendering process

Before a contractor can tender to MRWA, they need to be prequalified. MRWA has introduced this process to mitigate some of the risks associated with contracting. It is based on the National Prequalification System which has been developed for Austroads. The prequalification process is ongoing, the following being assessed (MRWA n.d., 3):

- The "contractor's capacities" (ibid).

- Finances and technical ability.
- Previous performances, performance while the project is underway, and then when completed.

In some MRWA jurisdictions, the contractor may have to renew their prequalified status after a certain period of time (ibid).

Contractors are required to apply for one of a number of prequalification levels, which they believe suits their capacity. The five levels can be found in MRWA's *GUIDELINES: National Prequalification System for Civil (Road and Bridge) Construction Contracts* (n.d.). A Financial level will also be given to a contractor.

Once a contractor is prequalified, they may begin the tendering process. There are two main categories for projects (MRWA n.d.):

- Category 1
    - Large projects which are often use the design/construct or alliance model for delivery. Contractors need to be prequalified.
- Category 2
    - These are smaller projects which design and construct are tendered separately by MRWA or; using the design and construct model. Contractors need to be prequalified by the time the project tender is advertised.

Unfortunately, no more information on MRWA's tendering process is publically available than the above. When contacted, MRWA was unable to assist.

In the interest of transparency for both the public and the tendering contractors, it is one of the recommendations of this report that MRWA outlines the process(es) which it goes through when tendering work.

Project Design

Before any construction or improvements are begun on the road, it needs to be designed. The object of designing a road is to make it functional in the given context of physical conditions and budgetary constraints.

Theories of Design

In *A Guide to Road Design*, Veith and Bennett introduce two theories which can assist a designer in building a road.

"Context-sensitive design is a concept that emphasises the development of an appropriate and cost-effective design for the particular context that applies, rather than simply meets the specified limiting values." (2009, 8). In other words, a designer must take into consideration the context of the project when they are designing a road. This context can include the environment, the type and volume of traffic, social expectations and the constraints of the project.

A way of implementing context sensitive design is that of the design domain concept. In any given project, a number of different elements of the design exist (such as shoulder width). For these different elements, there are a range of values that can be applied to them (such as size of shoulder width). At one end of the range, there are values that would be considered by usual engineering standards (tests, reasoning) unsafe or inefficient, but are usually cheap (a small shoulder width may increase the incidence of accidents or severity of them, but is cheap to purchase and maintain). At the other, the values may be too expensive for the benefit they give to the project (a large shoulder width may not decrease

accidents, but the land is expensive to procure and maintain). Within this range is a region of values which are considered as reasonable for a project.

The design domain concept adheres to the principle that values should be selected for a particular element based on objective data for "the changes in cost, safety and levels of service caused by changes in the design" (Veith, Bennett and Armistead 2006, 8). Where the data is not available, the designer needs to make an assessment based on the texts of the profession. The designer should not allow the values to fall below a range, to a point where road user's lives are put at risk, the project becomes expensive, or the road authority is open to legal liability. However, in most projects the designer is not able to work on a blank canvas. In this case, a compromise is needed between the different elements of a design and these decisions "call for knowledge, experience, insight, and a good appreciation of community values" (Veith, Bennett and Armistead 2006, 9)

The advantages of following the design domain concept are that it:

- Encourages a holistic approach to designing roads by emphasising the interrelationship of different elements
- Allows the designer to create innovative designs without having to follow rigid standards
- Formalises safety considerations in designing a road

A Road Hierarchy

In designing a road, the biggest factor which is considered by the designer is what the purpose of the road will be. To describe this, a road classification system is needed. While there are currently nine different classification systems in use by Western Australian authorities, I have chosen to use the WAPC's functional classification system to be found in Policy DC 1.4 (1998).

- Primary Distributors
    - Move very high volumes of different types of traffic from one region to another. Include freeways and highways. Examples: The Kwinana Freeway, and the Tonkin Highway.
- District Distributors
    - Move high volumes of traffic between commercial, residential, and industrial areas. Often form a grid pattern on the map. Examples include Nicholson Road and Warnbro Sound Avenue.
- Local Distributors
    - Move traffic within the cell (the square created by the District Distributors). It connects access roads with District distributors.
- Access Roads
    - Give vehicular access to abutting properties.

The road building standards that will be applied to the road differ with each of these roads.

Factors in the design

In any design of a road, there are five main considerations for a designer.

Geometric design "refers to the calculations and analyses made by the transportation engineers (or designers) to fit the highway to the topography of the site while meeting the safety, service and performance standards" (Cheu 2006, 6-1). The way a road is designed is greatly influenced by the lie of the land on which it sits. The curves which are created, horizontal, vertical and cross sectional, are influenced by the purpose of the road. They must accommodate (ibid, 6-22):

- The type of traffic
- The comfort of the people in the vehicles
- Volume of traffic, and;
- Speed of traffic

As well as give regards to the driver's line of sight. This is extremely important for the safety of a road. Specific standards for these elements for Western Australian roads can be found in the Austroads guidelines and the MRWA website.

Intersections and crossings can be considered another major factor in road design. When two or more roads cross, this is considered an intersection. They can take many forms and shapes. Considerations for a designer may include (Veith and Arndt 2009):

- The road user
    - The user may include many different types of vehicle, from cyclist to B-doubles.
- Provision for large/special vehicles
    - Provide for large sweep paths, stopping distances and large radii for turning. (radii standards can be found on the MRWA website (MRWA Supplement to Austroads Guide to Road Design - Part 4: 5.6 Design Vehicle Swept Path 2012)
- Topography and land availability
    - The topography can affect the safety of the intersection, and so extensive earthworks may be required. In urban areas land may not be available or may be expensive to procure. All of this adds to the cost of the project.
- Environment and heritage
    - The intersection has an effect of the surrounding environment, and a design which mitigates some of these effects should be considered.
- Physical constraints
    - The position of services, other roads and intersections, buildings and bridges
        - Services can include:
            - Communications
            - Sewers
            - Water mains
            - Western power feeders
            - Gas mains

- Occupational health and safety
    - "Intersections should provide for the occupational health and safety of road maintenance workers and others who have to undertake vocational responsibilities at or near intersections" (ibid, 15).

However, for the designer of a road, the most important consideration is that the intersection is appropriate for the intended function. This means that the designer must choose a specific design to suit the road's intended use. For example, it would not make sense to build a primary distributor interchange for a local distributor.

Drainage is another design consideration. It is important to provide adequate drainage for a road for the following reasons (Armistead, et al. 2010):

- To prevent erosion of the road surface and it's foundations
- To prevent flooding of the area
- Water on the road surface can be a serious safety hazard: it prevents the vehicle tyres gripping the road properly which can lead to a loss of control.

Selection of the correct drainage system relies on a number of factors at the particular site (ibid, 7):

- How much water the system should handle (MRWA uses Australian Rainfall and Runoff (Engineers Australia 2001) as guidelines (MRWA 2002))
- The frequency of the rainfall
- The efficiently of the design
- How the drainage system fits in the project as a whole
- The cost of building and maintaining the system
- Health and safety considerations of the workers who build and maintain the system
- What will happen is the system fails
- The surrounding environment

The design of the roadside is also a consideration for the designer. The main objective for the designer is to make the roadside as safe as possible. This means that there is "a practical and economic balance between the assessed risks of hazardous consequences and the measures needed to mitigate those risks." (Veith 2010, 7). Safety is not only confined to cars, but also to other road users such as pedestrians and cyclists. Furthermore, other people who might be at risk, such as those who live next to a road, have to be considered. Veith also outlines a systematic method to reduce risk (ibid):

- Reduction inherent hazard
    - By designing a road system which is inherently safe, the designer can reduce the inherent hazards that exist within a given design. This is more desirable than creating layers of safety devices, as not one can these fail, but they also present safety hazards themselves (such as barriers to motorcyclists).
- Prevention of an incident
    - Veith argues that loss of control of a vehicle can be the cause accidents. By preventing this, the risk of an accident can be lowered. An example could be proper drainage, preventing aquaplaning.

- Limiting damage
    - The consequences of an accident can be limited through a number of measures, such as installing protections systems (roadside barriers). This can control and contain the accident.

But designing an inherently safe system is not only confined to new designs. A designer can also turn their attention to existing roads. Veith also outlines a generic process for this (ibid, 11):

- Determine area of interest
- Identify the hazards
- Identify the appropriate treatment options to reduce risk
- Evaluate treatment options using quantitative and qualitative assessment
- Rank treatment options and recommend preferred action
- Design roadside treatments

The final consideration for a designer is the results of a geotechnical investigation. Geotechnical engineering is the study of the engineering behaviour of soils, and the application of this knowledge when it is used as a construction material or as a foundation material (Venkatramaiah 2006, 1).

The investigation is important, as it tells a designer (Paul and Grove 2008, 1):

- The location, extent and nature of idiosyncrasies in the soil which could affect the project
- The effects of the project on the soil on which it sits
- The suitability of material for the project construction and its location

These five considerations all affect the final design of a project. They are interrelated: a change in one category could result in changes to another. For example, a change in the road alignment might result in a change in drainage needs.

It is important to emphasise that road design cannot be considered a simple interchange of values. There is, and will continue be into the future, a great deal of art mixed in with the science.

Construction

A great part of the success of the construction of a road relies on the previous stages of a project and good logistical planning. It can be hugely challenging, throwing up problems and complexities that were not predicted or expected. This is when the individual skill, motivation, and character of the contractor and their relationship with the road authority become of paramount importance.

Types of road

There are two main types of pavement and bases: flexible, and rigid (Wright and Paquette 1987, 470).

Flexible pavements distribute the load over the subbase (the ground beneath the road) evenly and rely on "aggregate interlock, particle friction and cohesion for stability" (Highway Research Board 1970). Typically, the road consists of (Mamlouk 2006, 8-1) (Wright and Paquette 1987, 474):

- Surface
    - In sealed roads, this is usually hot-mix asphalt concrete
- Base course
- Subbase
- Subgrade

The use and thickness of these stages depend on the use of the road, it's desired working life, the environmental conditions of the area, as well as the materials used (Mamlouk 2006, 8-2). MRWA has published it's guidelines for determining the thicknesses under *Engineering Road Note 9* (MRWA: Materials Engineering Branch 2010).

Rigid pavements are usually prepared using Portland cement, sometimes reinforced throughout with steel. These surfaces have the ability to 'bridge' over inconsistences in the base on which they are laid. They have been built extensively in the U.S. and in other Australian states, but the high cost of concrete due to its low availability, and the easy accessibility of suitable aggregates, has meant that concrete roads are seldom built in Western Australia (Kenworthy-Groen 2012). Therefore, I will largely ignore this class of road in this section.

Preparation work

Firstly, the area is surveyed and control pegs set out. This enables "the layer level, shape and course thickness to be regulated" (de Carteret, et al. 2009, 25).

Subgrade

The subgrade is the ground level upon which the road sits. Proper preparation of the subgrade is essential, as the condition of the soils beneath the road will directly affect the long and short term performance of the project (Wright and Paquette 1987, 14-5).

Before any work is started, the alignment of the road is cleared of all organic material. This is because organic material may decay under the road, leading to idiosyncrasies in the surface. Topsoil may be detained for revegetating the area when the work is completed. On projects where previous infrastructure exists, the removal of old facilities also has to take place (ibid).

Once all this has taken place, earthworks for the site may start to take place. Earthworks for a road may take two eventual forms:

- Cutting
    - The road is laid where the ground has been dug away to make room for it. This form is common in hillsides or slopes.
- Embankment
    - The road is built on top of a large embankment of earth. The top is flat and horizontal. The angle of the edges of the embankment are important, to ensure structural stability. Embankments need to be built on a suitable subgrade.

At this stage, the excavation work for drains and other road structures are also completed.

The materials need to be tested on site to ensure that it is suitable to bear the road. If it is not, there are a number of options for the contractors, such as stabilization, bridging, or removal.

Compaction of the earthworks then takes place. Optimum compaction will depend on the material and its needed moisture content.

Subbase

The subbase is a course of material between the subgrade and the base course. It is used to distribute the weight of traffic further in the structure of the road. It can be a number of different types of material, including (Mamlouk 2006):

- Gravel
- Crushed stone
- Stabilized subgrade soil

Specialised equipment then control the compaction and moisture content of this layer (ibid). Note that for roads which do not have a high loading, this base may be omitted.

Base Course

The base course lies directly underneath the surface of the road, and is therefore subject to a deal great of pressure. It is made up of high quality untreated aggregates, which may include:

- Crushed stone
- Slag
- Gravel

Thickness of the base course depends on the "properties of other layers" (ibid, 14-8). But it is usually around 10 to 15 centimetres (ibid). The base is usually compacted and cut using a GPS guided grader to achieve the desired strength and shape.

Surface

The process described here is for hot mix asphalt concrete, which is by far the most common material used.

A prime coat is usually applied to the base course. The idea is to bind the aggregates together to prevent any movement and to provide a surface ready for the surface coat (ibid).

A tack coat is usually laid to prepare an old asphalt surface for resurfacing. It needs to be laid on a clean surface if being laid on bitumen (Rebbechi 2006). A truck sprays a "rapid setting cationic bitumen emulsion" onto the surface (ibid). Too much or too little can cause problems in the quality of the finished surface.

The material is spread over the surface to lay the asphalt to the "desired thickness and longitudinal and transverse shape" (ibid, 15). It can be done by hand, or by grader; but the most common method is by paver. This is because of the inadequacy of the other two methods to achieve either consistency or scale.

The paver is split into two main parts: the tractor and the screed. The tractor proves the power for the machine. Asphalt is fed into the tractor; it is conveyed to the back, where it is distributed on the road surface by augers. The screed pushes down on the mix, forming the 'mat': the only slightly compress road surface. There are a number of variables which can affect the quality of surface produced by the paver, and it takes an experienced and skilled operator to correctly use the machine.

The material is trucked to the project from a mixing site, where it is either dumped into the hopper of the paver or into a Materials Transfers Device. The logistics of the trucks are important: the asphalt must not cool and the paver must get a constant supply of asphalt to enable it to work continuously.

Where one edge of the mat meets the other mat is called a joint. Joints are potential areas of weakness, as they allow water to permeate the surface. Further, if placed under stress from traffic, they may crack. Joints need to be correctly placed and completed to prevent this.

When the mat has been laid, it is then compacted: usually by rollers.

Materials

Sourcing the right materials for a road is absolutely essential if a road is to be successful. There are a number of important items to consider (Blades and Kearney 2004, 5):

- Gradation
    - The size of the individual grains in a material. There is a sliding scale, from large grains to fines: very small grains. Any aggregate is made up of a mixture of these grains, with certain combinations be advantageous for road building (ibid, 6).
- Permeability
    - The ease which water flows through the material. Aggregates which allow water to flow through are desirable, as water in the soil reduces its strength (ibid).
- Capillary
    - "[…] the upward movement of water by capillary action through a fine soil." (ibid, 7). This is the amount of water the soil pulls into itself.
- Plasticity
    - The amount of flexibility under pressure the soil has before it cracks. It is desirable to have a soil which does not return to the original shape, as it is able to be rolled into thin crusts (ibid, 7).
- Frost susceptibility
    - This is how susceptible the soil is to ice forming within it when it is cooled. When water is frozen, the ice that forms takes up a larger area than the water it came from. This means that if ice forms in the soil, it can drive the material apart. This results in cracking of the road surface.

In Western Australia, most of the road network "is constructed with naturally occurring lateritic type gravels and or crush igneous rocks such as granite" (Kenworthy-Groen 2012).

Post-build

It is a mistake to believe that once a project is completed, the work stops. Roads and infrastructure that supports them need to be constantly maintained. If the infrastructure is not maintained, the road will fall into disrepair and eventually become impassable – and expensive to rebuild. Indeed, it is now well documented that when the interstate highway system was built in the U.S., it was not maintained. Administrators believed that a road, once built, was finished. The system fell into disrepair. Eventually, the U.S. Federal government had to step in and establish a fund to maintain the system (Kaszynski 2000) (FHWA 2011).

Types of Maintenance

To avoid the road asset degrading to such a state here in Western Australia, most of the work done by MRWA and LGs is maintenance. Maintenance tasks fall into three categories:

- Reactive maintenance
    - These are general day to day activities, which have low technical requirements. The maintenance is a response to a defect in the road asset. The work can include pothole filling, reparation of cracks, clearing of road verges, clearing drains, fixing signs, and maintaining road markings (Auditor General for Scotland 2004, 32).
- Proactive maintenance
    - This maintenance is a great deal more complicated and expensive. It is "designed to replace major life-expired elements of the road and to ensure that the design life is achieved or extended." (ibid). It often includes

resurfacing work, or correcting minor design flaws (Western Australian Auditor General 2009, 10). Usually, the work is planned as part of a strategy to maintain the road asset.

- Emergency work
    - This work is a response to, by definition, sudden unexpected events. As such, work can vary greatly in what form the response can take. It can include, but is not limited to: natural disasters, reparation of damage caused by accidents, assisting emergency services, removal of obstructions, and finally, repairs of faulty or vandalised equipment (Auditor General for Scotland 2004, 11).

Methods to Evaluate Roads

(MRWA has been contacted.)

Maintenance: a Stitch in Time…

It is important to note that "regular reactive maintenance and resurfacing is more cost effective than rebuilding deteriorated roads" (Western Australian Auditor General 2009). Rebuilding a road is hugely expensive, in comparison to incremental maintenance tasks. However, as the road degrades, more resources are needed to bring it back to an acceptable standard.

In certain Western Australian circles, it is now well known that the money available for maintenance of both state and local roads is simply inadequate for the task. It has been this way for the last decade. "It has been evident, since this form of reporting was introduced in 1993 that Local Government in WA does not have the financial resources that are required to maintain its road network and to keep up with its road improvement needs." (WALGA 2011, 19).

Given this situation, Western Australian LGs and MRWA have formed Regional Road Groups and their sub-groups to direct limited funds in a more strategic way. They are made up of MRWA representatives and elected councillors. They identify, prioritise and fund projects that are not limited to one LG area. Furthermore, each LG maintains software designed to assist with the maintenance task, called ROMAN II. A report is published by the Western Australian Local Government Association (WALGA) annually on the road asset and expenditure on it. Finally, LGs meet annually in a road forum to address common issues.

According to the Department of Regional Australia Local Government Arts and Sport, the same challenge is faced in other Australian states, New Zealand, the U.K., the U.S., and Canada (2010). I recommend that with this given situation, a great deal of co-operative research could be done with, and on, other international road authorities. Indeed, MRWA already has a long history of this (Edmonds 1997, 201, 245, 269-72). Not only would this reduce the costs for both parties through shared research, it would foster international connections and relationships. I also recommend that a great deal more co-operation could also take place domestically between state Road Authorities. The infrastructure is already in place for this in the form of Austroads (formally NAASRA).

Upgrades and Improvements

But maintenance is not the only work done on roads. It is sometimes necessary to upgrade and make improvements to a section of road. The process outlined in this report for building roads is much the same as for upgrading or making an improvement to the road asset.

Of course, upgrading an old system can be a great deal more complicated than building a new asset on a greenfield site. An upgrade often takes place because the road asset is already over capacity. Not only does the old asset have to be taken into consideration, but the surrounding area may have become a great deal more developed than when the original asset was built.

If future consideration is given to these upgrades, it can make the process technically easier, financial cheaper and more predictable, and socially and environmentally more sustainable. Considerations might include:

- Setting aside land
- Preparing other assets for the upgrade
    - An example might be building a roundabout for dual carriageways, but only building single lane roads for it.
- Designing with the future in mind
    - Services could be placed in the final position (when upgrading a road, the responsible road authority also has to pay for and organise the movement of these services by other relevant authorities).

The planning hierarchy in Western Australia [see above], now empowers road authorities to build roads with the future in mind. However, as with all road building, there is art with the science. Plans might be abandoned (such as the last stage of the Roe Highway) or changed significantly.

Conclusion

In this report I have created one process of construction and upgrading of roads in Metropolitan Western Australia, by tabulating the various processes into one formal document. I have shown that the initial idea for a road project can come from a great many sources. I then showed how a typical project is planned, financed, delivered and constructed. It is true to say that the road building process in Western Australia is complex, however, this should not be interpreted as a weakness. The system has evolved ad hoc over time, and is a result of lifetimes of work for certain individuals. It should be highlighted at this point that Western Australians continue to enjoy a reasonably efficient and well maintained system, even given often under resourced road authorities.

I do recommend however that more research should be done on the Western Australian road system. Information is excruciatingly difficult to get hold of on the subject. By increasing awareness of the important work that takes place on the road system, it would achieve a number of ends:

- Change funding priorities to make roads more important, which as highlighted above, might become a problem in the future.
- Inject new talent, skills, methods and ideas into the industry. The permeability of the industry to new ideas is excellent, but it needs to attract, train and retain skilled workers.
- Enable Western Australia to become a global leader in road building and administration.

I have also made some specialised recommendations throughout this report. To sum these up:

- MRWA needs to outline the process(es) which it goes through when tendering work.
- More cooperative research on road maintenance needs to done with other Australian states and other nations.

Part B: Roads in the Southern River Electorate

Introduction

Southern River electorate is located in the South of Perth, and includes in its boundaries a number of local governments. The area has experienced a huge growth in population over the last decade and, with a number of residential developments in the pipeline, looks set to become home to an even greater number of people. This boost in population will require the use of roads. In this section of the report, I describe some of the main routes in the Southern River Electorate, which include: Nicholson Road, Ranford road, Warton Road, Southern River Road, and Garden Street.

I will describe what work each city has undertaken on these routes since 1997. However, the reader may note that some routes have no written history before 2002.

I will concentrate my efforts on upgrade work each road authority has taken, and largely ignore maintenance work.

Nicholson Road

Nicholson Road runs from Thomas Road in the south, to the Albany Highway in the North. As it is a local road, it is managed by the Cities of Armadale, Gosnells, and Canning; as well as the Shire of Serpentine-Jarrahdale. Nicholson was originally part of the heavy haulage route for B doubles (X 2012). However, the function of this road has changed from this industrial purpose, with the heavy haulage route designation being removed 2010 (City of Armadale 2011, 7). In this section, I concentrate on the some 12 kilometres from Armadale Road to Wilfred Road, which is managed by the cities of Gosnells, Canning and Armadale.

Nicholson Road in the City of Armadale

In the last decade, there has been a great deal of work on Nicholson Road. In 2003, construction of a dual carriageway began at the intersection with Warton Road (City of Armadale 2003, 9). At the cost of $320,000, the roundabout was completed in 2004. The City part funded the project with the help of federal and state Black Spot Funds (City of Armadale 2004, 4).

Figure 1: Nicholson road from Rowley road in the south, to Warton Road in the north. (Digital Mapping Solutions 2012)

But by far the largest project that has had an impact on Nicholson road and which will continue to do so into the future, is the residential development of Harrisdale and Piara Waters (X 2012). Planning began for this area in 2004, and in the same year the City began the process to amend the Metropolitan Region Scheme and the City's Town Planning Scheme (City of Armadale 2004). The extent of the development can be seen clearly in Figure 2.

Nicholson Road's function has and will continue to change from an industrial route, to a District Distributor for this residential area. A number of upgrades have already taken place on this road to prepare it for its future function.

The project to dual Nicholson Road extends from Warton Road to Armadale Road (shown on Figure 2a) and is split into four stages.

Stage one from Warton Road to Harrisdale Drive was completed in 2008. Stage 2 from Harrisdale Drive to Mason Road will be completed in December 2012. Stage 3, from Mason Road to Piara drive is also planned to be completed at the same time. The final stage extending to Armadale Road is proposed for January 2013.

To fund this project of "several million dollars", the City is using Development Scheme No.3, requiring subdividers to make equal contributions to fund needed infrastructure (City of Armadale 2008, 8).

Nicholson Road in the City of Canning

From Warton Road, until it veers to the north-east at Birnam Road, Nicholson Road forms the boundary between the Cities of Canning and Gosnells. See Figure 3.

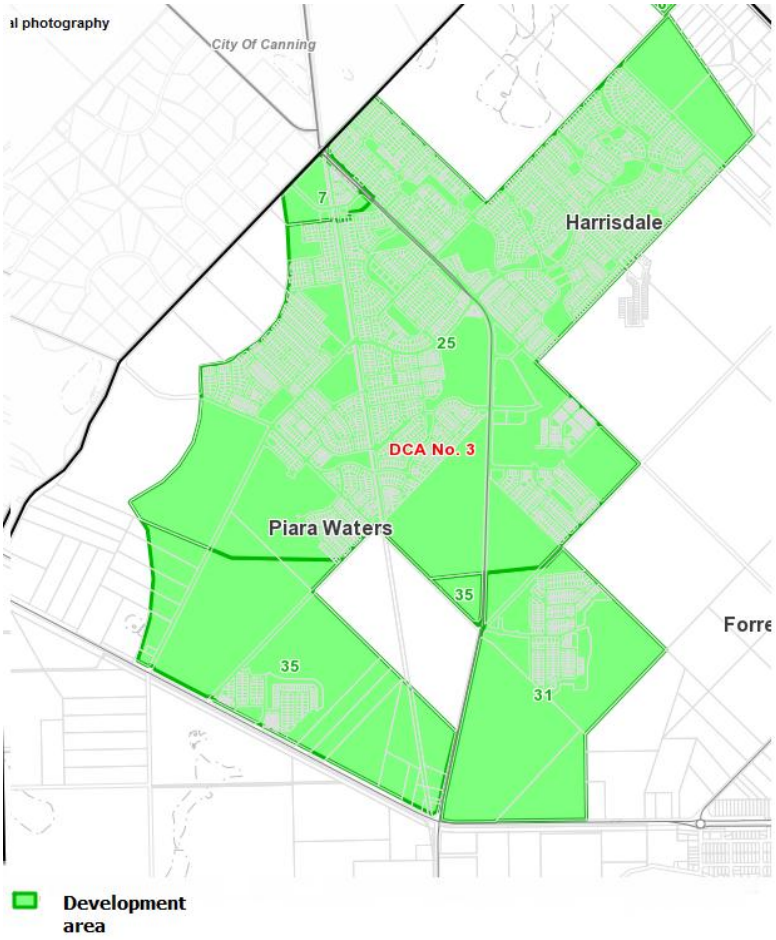


Figure 2: Development area of North Forrestdale (Digital Mapping Solutions 2012)

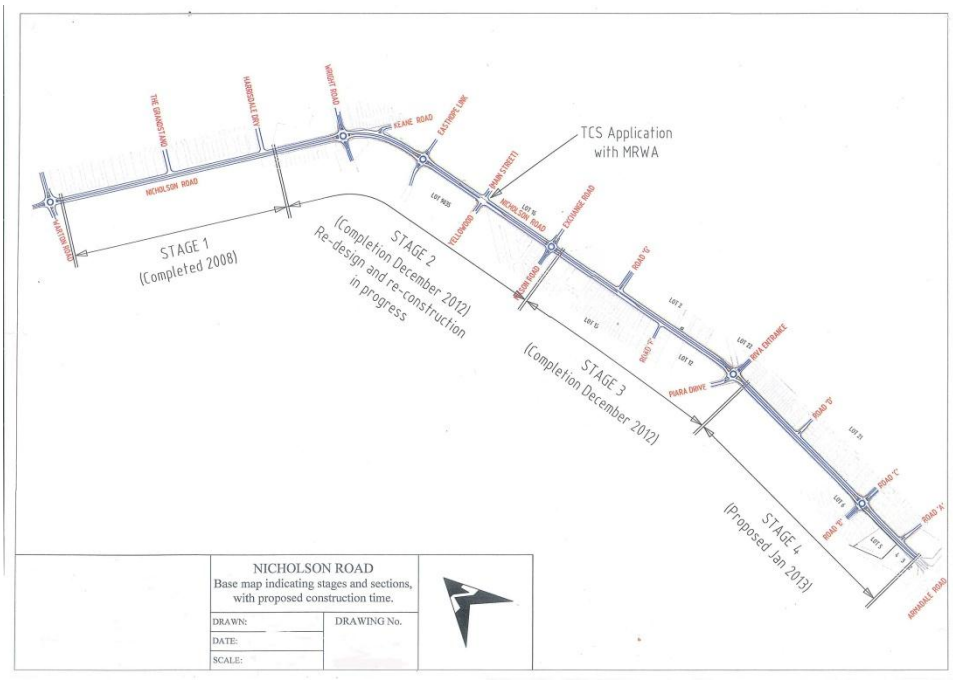


Figure 2a: Stages of development on Nicholson Road from Armadale Road to Warton Road (X 2012)

A great deal of work has been done by Canning. The City dualled the road from Ranford Road to Eucalyptus Boulevard in 1999 (City of Canning 1999, 8). In 2001 the City constructed a two lane roundabout on the High Road intersection (City of Canning 2002, 16). 2004 saw the City duel the road again between Dumbarton Road and Birnam Street (Canning 2005, 18) and

in 2008, it was dualled between Clifton Road and Acourt Road (City of Canning 2009, xvii). The City of Gosnells contributed to funding for all of this work. See figure 4.

Further, Rod McConkey of the City of Gosnells commented that the "section from Ranford Road to Garron Rest [is] currently being designed for dual carriageway upgrade" (McConkey 2012). See figure 4.

Figure 3: Nicholson Road as it runs from Warton Road in the south, to the north eastern turn at Birnam Road (Digital Mapping Solutions 2010).

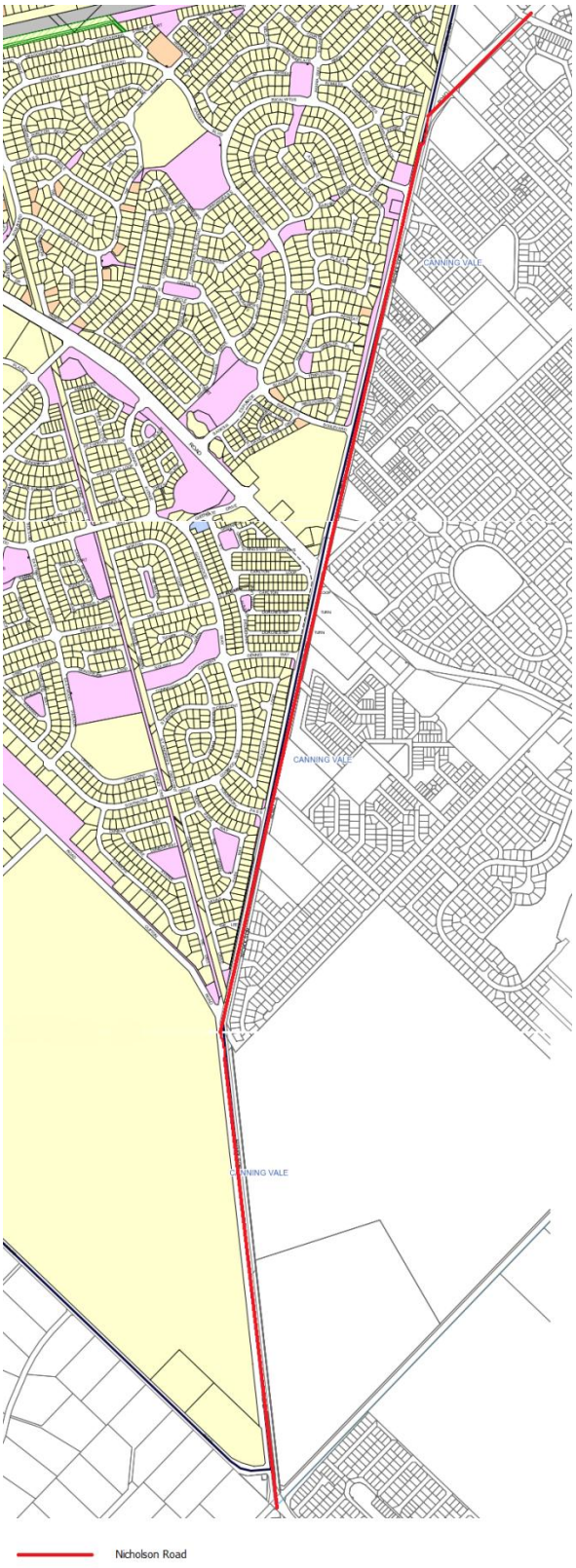
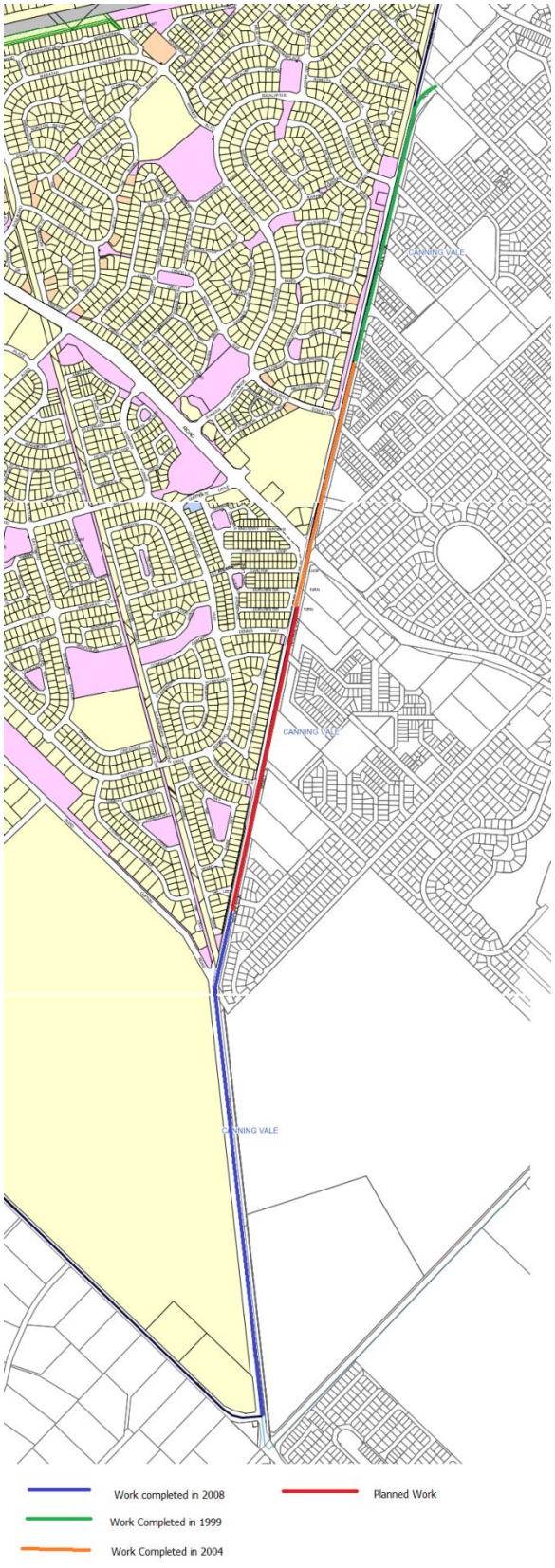


Figure 4: Dualling completed on Nicholson Road since 1999 (Digital Mapping Solutions 2010).



Nicholson Road in the City of Gosnells

Even though the City of Gosnells has full responsibility of only part of Nicholson road, it has not neglected doing work on this section.

In 2001, the City began work on a drainage problem by Birnam Rd (City of Gosnells 2002, 15). In 2003, the City completed rehabilitating the road from Brookman Ave to Langford Ave (City of Gosnells 2003, 48). Several major projects were either begun or completed in 2004, with improvements at the Nicholson Road/Spencer Road intersection, which included anti-skid treatments, for a cost of $110,000, and a $46,000 left turn lane for Lanford Ave (City of Gosnells 2004, 21). The City also began duplicating Nicholson road between Garden Street and Bannister Road, which was completed in 2005 (City of Gosnells 2005, 17).

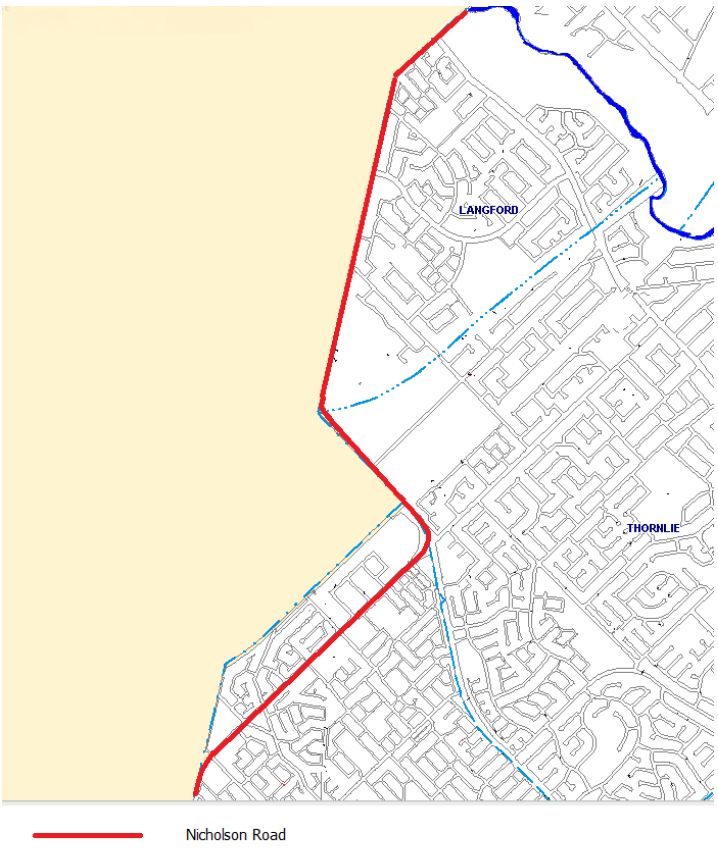


Figure 5: Nicholson road as it runs north-east through the City of Gosnells**,** before it terminates at the Albany Highway (MapXtreme 2008)

2006 saw the City begin to plan and design the duplication of Nicholson Road between Birnam Street and Garden Street (City of Gosnells 2006). In 2008, the City installed traffic signals at the Amherst road intersection, at a cost of $140,000.

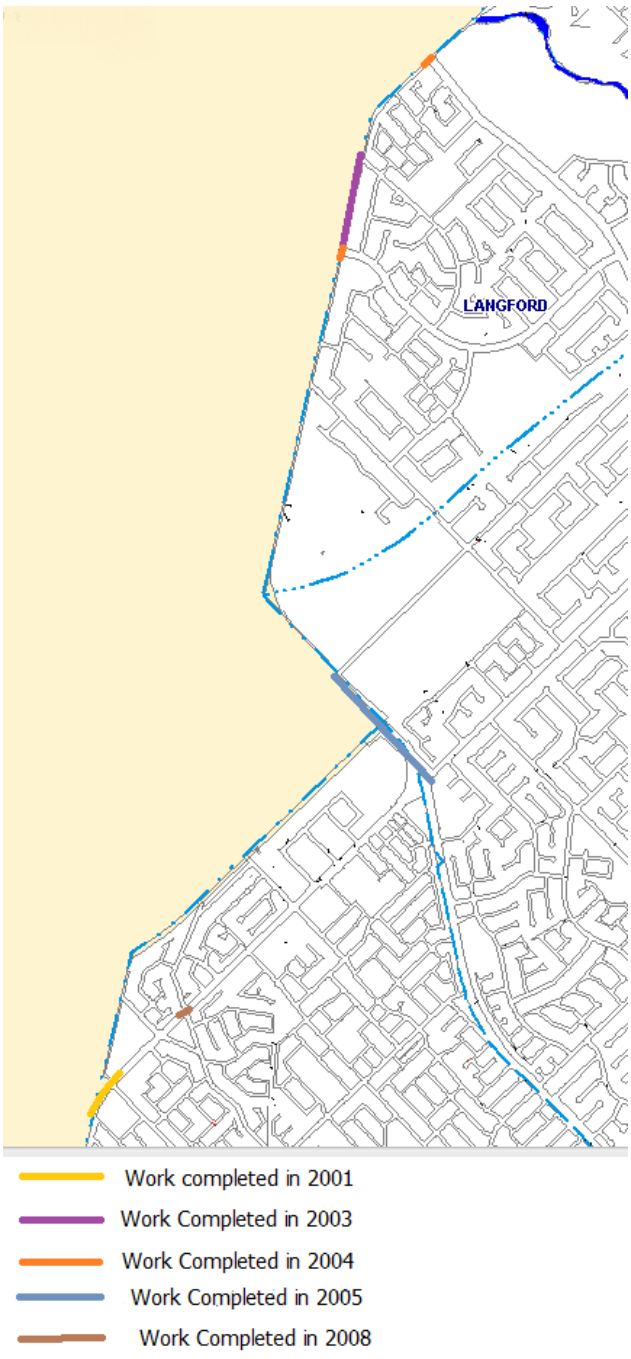


Figure 6: Work completed on Nicholson Road by the City of Gosnells (MapXtreme 2008)

Ranford Road

Ranford road runs from Lake Road in Armadale to eventually become South Street at the Roe Highway intersection. Ranford road is a local road, and as such is managed by the Cities of Armadale, Gosnells, and Canning. In this part, I will concentrate on the some 12 kilometres between Bannister Road and Lake Road.

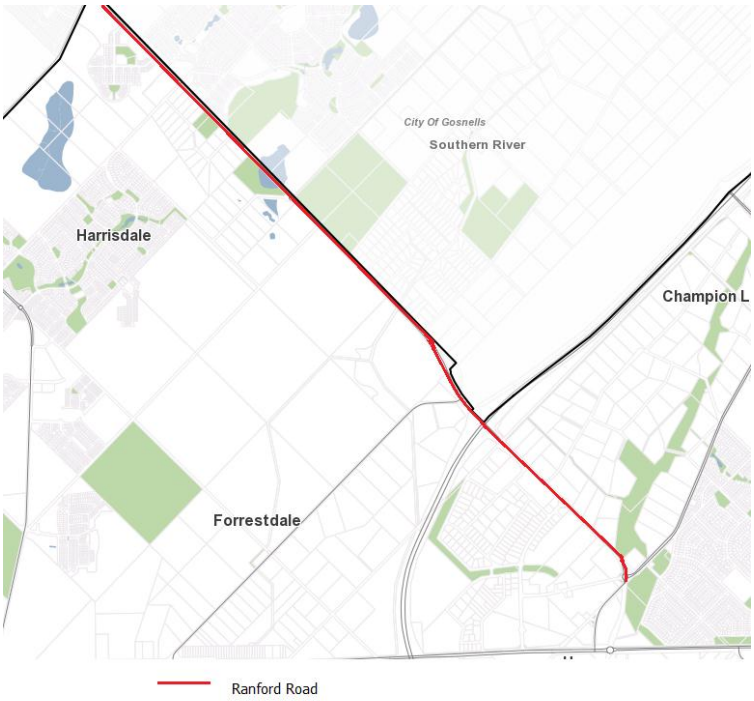
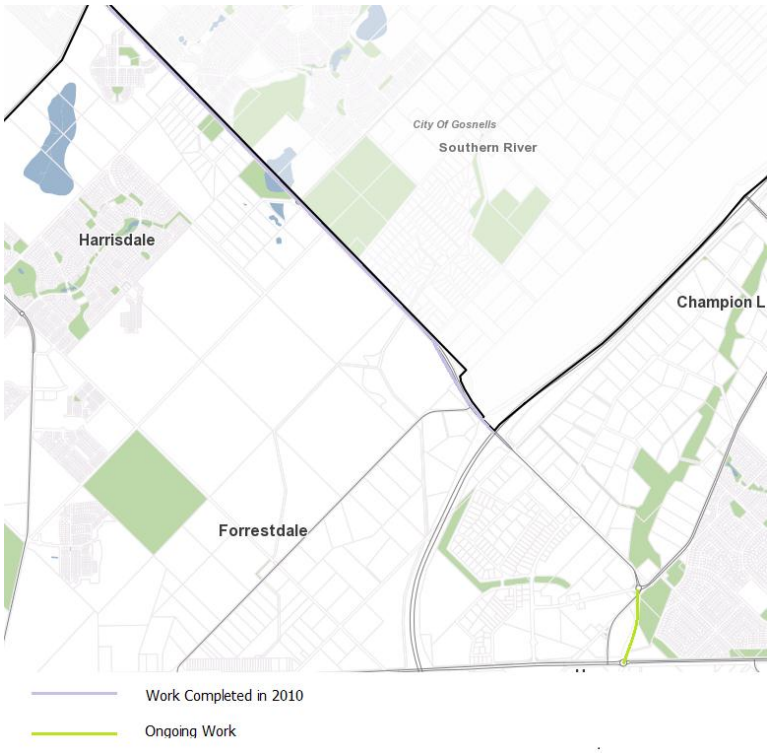


Figure 7: Ranford road, from Lake Road in the South to Warton Road in the north (Digital Mapping Solutions 2012). Note that Stage 3 is not shown.

Ranford Road in the City of Armadale

Armadale is responsible for the section of Ranford Road from Lake Road to Warton Road.

Armadale has completed a great deal of work on Ranford Road in the last few years. This reflects the new development in the area. In 2002, planning began for a business park in Forrestdale, which would require the upgrade of Ranford Road and Armadale Road (City of Armadale 2003, 11).



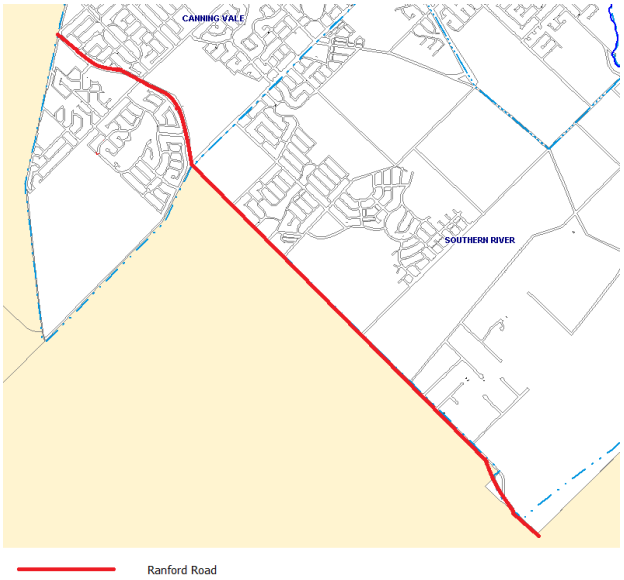
The City planned to duplicate Ranford Road between Warton Road and the Tonkin Highway in four stages. In 2010, the city completed stage one between the Tonkin Highway and Southern River Road (City of Armadale 2010, 2). Stage two, between Southern River Road and Warton Road, was planned in the period 2006 to 2008

Figure 8: Work Completed by the City of Armadale on Ranford Road. (Digital Mapping Solutions 2012).

and was finished in 2009 (ibid, 18). It cost the City $2.1 million, and it managed to get the rest of the funding from the Federal Government and Gosnells (City of Armadale 2010) (City of Gosnells 2008, 22). Stage Three between the Remesko Drive and Armadale rRoad, at the time of writing, is currently taking place (ibid). Stage four, between the Tonkin Highway and Remesko Drive, is planned for 2013 (X 2012).

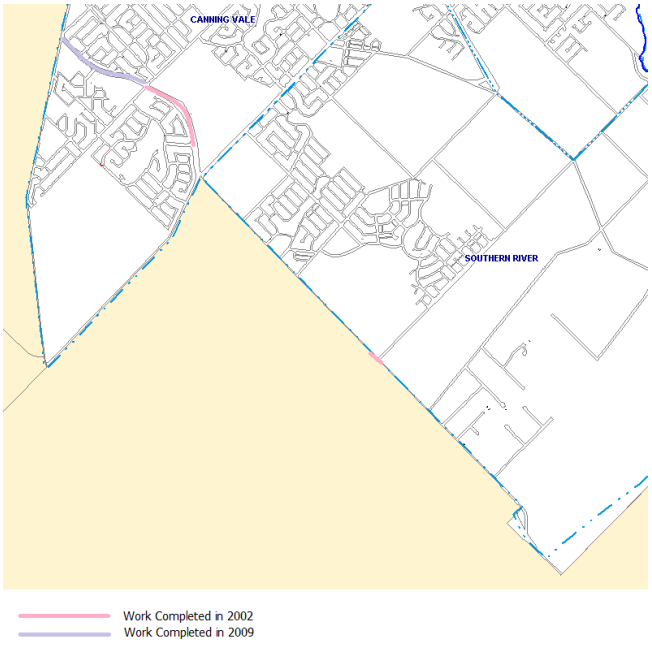
The EPA raised concerns during the planning for the project that Ranford Road had to be taken through a Class A Reserve: Balannup Lake (ibid). It took the city four years to get approval, after obtaining special permission from the Minister for Planning. The City managed to get this permission, given that the road would have to take a very long detour either to the north or south (ibid). Further, the position of a chicken farm at lot 508, on the route of the Ranford Road, had already degraded the reserve (ibid).

Figure 9: Ranford road, from Tonkin Highway in the South to Nicholson Road in the north (MapXtreme 2008).



Ranford Road in Gosnells

Gosnells is fully responsible for the section of Ranford Road between Nicholson Road and Warton road, but shares the responsibility for the section between Warton Road and the Tonkin Highway with Armadale.



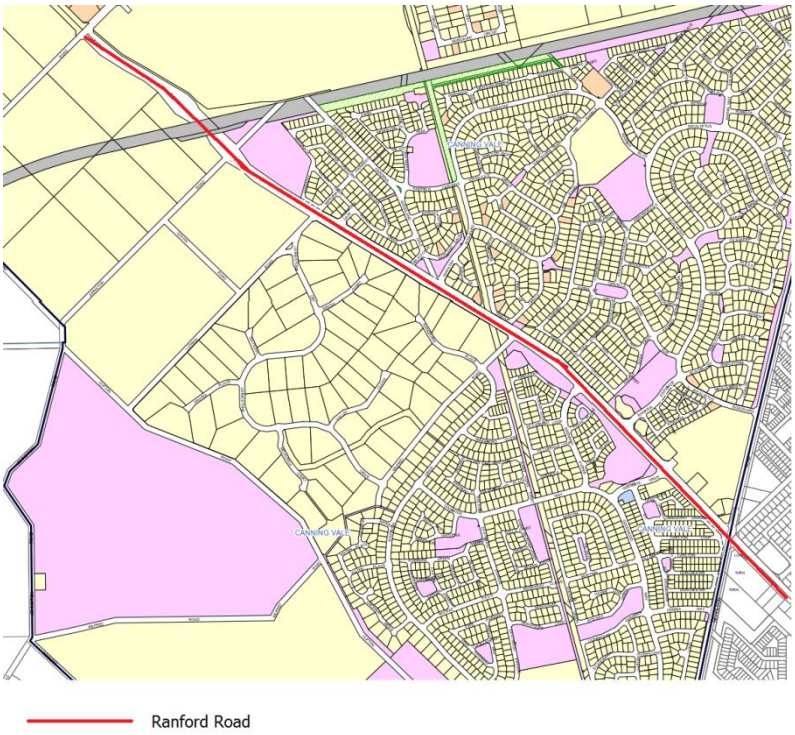
In 2002 Gosnells duplicated Ranford road between Sanctuary Ave and Campbell Road (City of Gosnells 2002, 19). The second part, from Nicholson Road to Campbell Road, was started in 2008 for a cost of 1.7 million (City of Gosnells 2009, 11). It was completed in 2009, with a further 1.3 million being spent (City of Gosnells 2010, 11). The intersection at Southern River Road was improved for a cost of $300,000 under

Figure 10: Work Completed on Ranford Road by Gosnells. (MapXtreme 2008).

the auspices of the black spot program (City of Gosnells 2003, 21).

Ranford Road in Canning

Figure 11: Ranford Road from Nicholson Road in the south, to Bannister Road in the north (MapXtreme 2008).

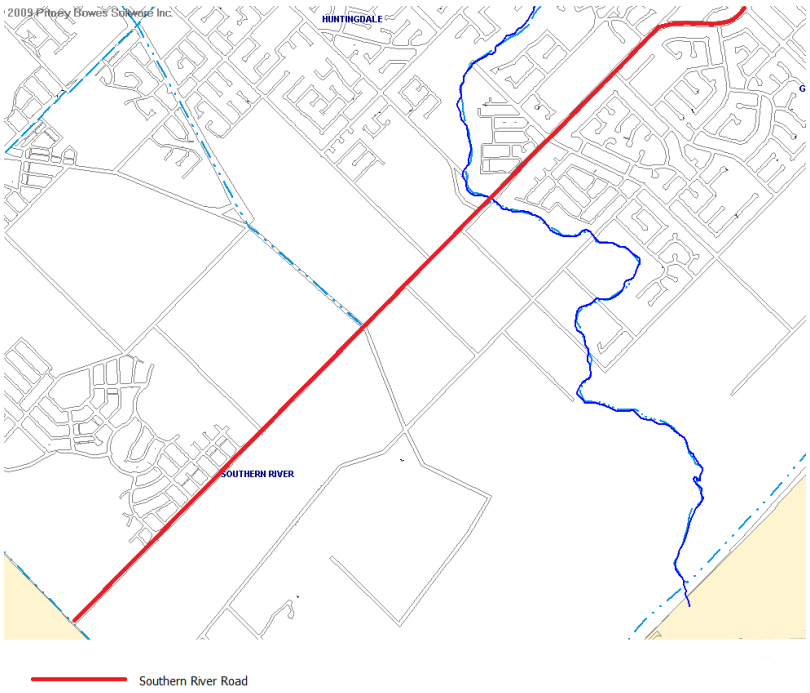


The only work which has been completed on Ranford Road since 1999 is the Ranford Road/Bannister Road intersection, which was upgraded in 2010 (City of Canning 2011, 22).

Southern River Road

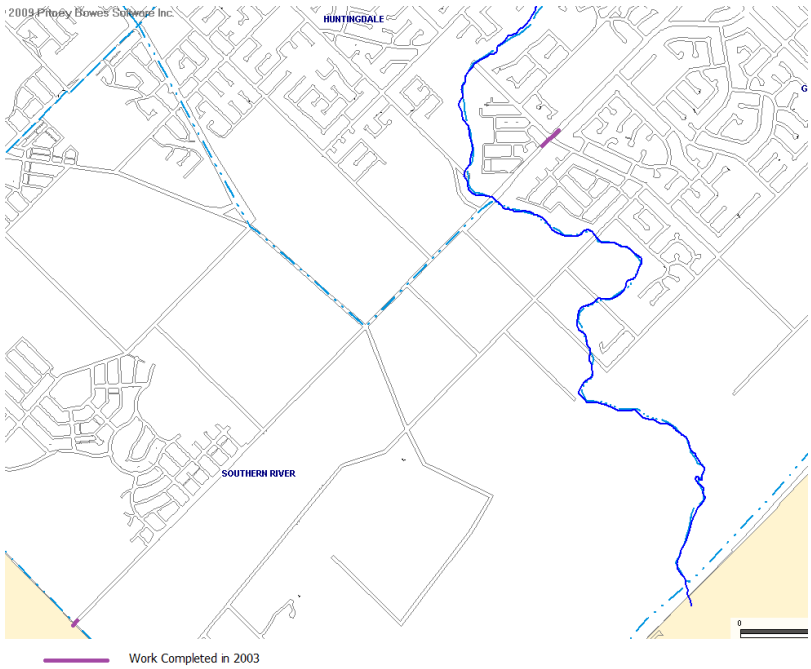
Southern River Road is a relatively short stretch of road at approximately 5.5 kilometres. It runs North-East from Ranford Road to Corfield Street, and is currently classified as a District Distributor A. It is a local road, managed by the City of Gosnells.

Figure 12: Southern River Road from Ranford Road in the south, to Corfield Street (MapXtreme 2008).



Southern River Road in the City of Gosnells

The only work which Gosnells has completed since 2002 is the upgrade of the intersections of Southern River Road/ Ranford Road, and Southern River Road/Chamberlain Street, which also received Black Spot Funding in 2003 (City of Gosnells 2004, 21).



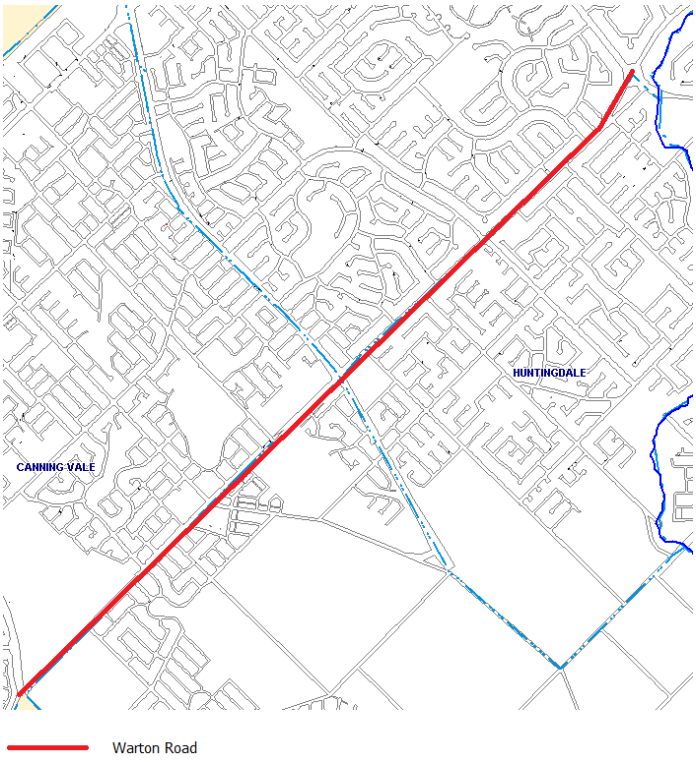
In future, the city hopes to upgrade the section of road between Bullfinch Road and Garden Street to a dual carriageway (McConkey 2012).

Figure 13: Work completed on Southern River Road in 2003 (MapXtreme 2008).

Warton Road

Warton Road runs some 12 kilometres north east from Armadale Road in the south before it becomes Burslem Drive at the Spencer Road intersection. Classified as a District Distributor A, it is a local road, and as such, is managed by the Cities of Gosnells and Armadale. In this section, I will concentrate on the stretch of road from Ranford Road to Spencer Road.

Figure 14: Warton Road from Ranford Road in the south to Spencer Road in the north (MapXtreme 2008).



Warton Road in the City of Gosnells

Gosnells has completed some major work on Warton Road. Warton Road was duplicated from Huntingdale Road to Garden Street in 2002 (City of Gosnells 2002). In 2004, the city extended the right hand turn pocket onto Spencer Road, and introduced anti-skid treatments, all for a cost of $190,000 (City of Gosnells 2004, 21). At the same cost was the Warton Road/Amherst Road intersection works, which included traffic signals and service relocations (ibid). When it was completed in the following year, the project cost almost a million dollars (City of Gosnells 2005, 17). In 2008, a major project to duplicate Warton Road between Ranford Road and Garden Street was begun (City of Gosnells 2009, 11). It was completed in 2009 (City of Gosnells 2010, 11). The continuation of this duplication was planned for the section between Garden street and

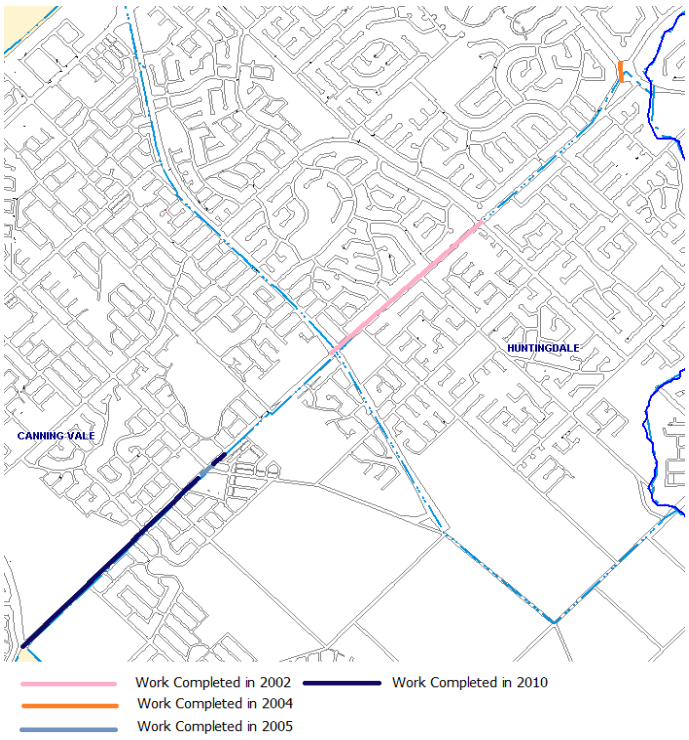


Figure 15: Work completed on Warton Road (MapXtreme 2008)

Batman Road in 2010 (City of Gosnells 2011, 12).

McConkey says that "Ranford Road to Nicholson Road will be upgraded as the area is developed […]" (2012).

Garden Street

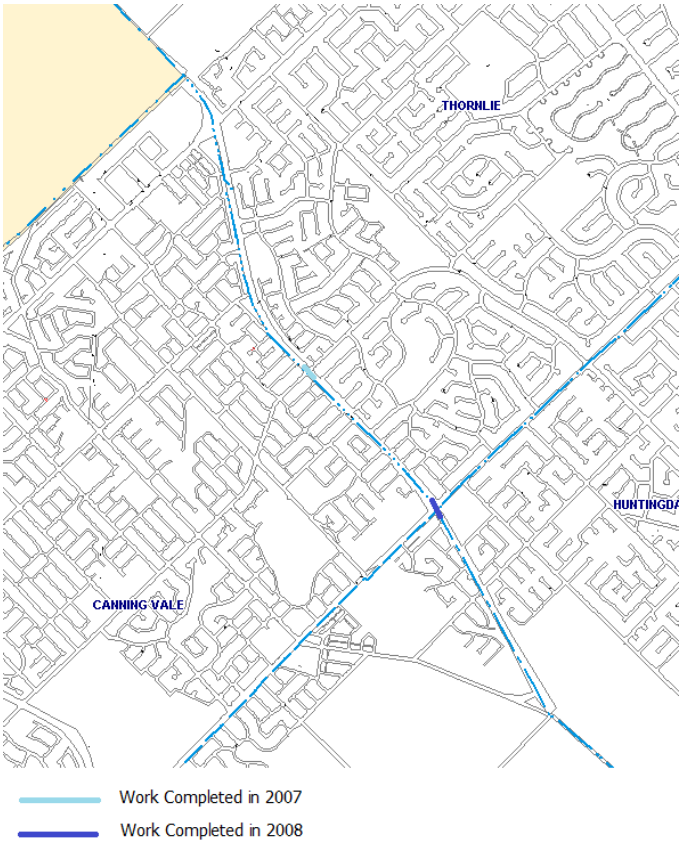
Garden Street runs for some 3.5 kilometres from Harpenden Street in the south, to join Nicholson Road in the north. It is classified as a District Distributor A, and is managed by the City of Gosnells.

Figure 16: Garden Street from Holmes Street in the south to Nicholson Road in the north. Note that the new section from Harpenden Street to Holmes Street is marked on this map. (MapXtreme 2008)

Garden Street in the City of Gosnells

Gosnells has completed a great deal of work since 2002.

In 2007, traffic signals were installed at the Garden Street/The Bridgeway/Forest Lakes drive (City of Gosnells 2008, 22) with the assistance of Black Spot funding. Preparation work for the extension of Garden Street to Harpenden Street was also carried out in the same year (ibid).



Traffic signals were installed at Garden Street/Warton Road intersection for a cost of $240,000 in 2008 (City of Gosnells 2009, 11). The following year saw the City plan to duplicate Garden Street between Nicholson Road and Forest Lakes Drive (City of Gosnells 2011, 12).

In 2011, the City planned to widen Garden Street between Nicholson Road and Warton Road, which the city

Figure 17: Work completed on Garden Street (MapXtreme 2008)

anticipates will cost $3.6 million (City of Gosnells 2012, 10). McConkey hopes this to be completed this financial year (2012). Furthermore, the section between Harpenden Street and Holmes is currently being designed (ibid).

Conclusion

On every route described, it is clear that each City has completed a great deal of work in the last 15 years. This can certainly be linked to the growth of population in the Southern River Electorate, and the trend looks to continue: a number of residential developments will increase the population further, and, this population will demand bigger, better roads. I have shown that already, plans are in the pipeline for major projects on these routes.

I have found that through writing this report that a great deal of information is either not available to the public, or simply does not exist. Given this situation, I recommend that when a LG completes a project, a report should be written by the concluding project manager detailing:

- What work has taken place
- Who was involved (contractors, designers, etc)
- Any challenges the authority faced, and what action was taken to overcome it.
- Any action which needs to take place in the future (maintenance, monitoring traffic conditions, etc)

This would have the following benefits:

- Add continuity for those people engaged in future projects on the same stretch of road
- Record a history of development of the road system
- Teach students and trainees the skill of road building and project management

The report could be made available to the public, or archived with the LG.

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